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ABSTRACT

This study was conducted to investigate persistence rates and gender differences among science students at John Abbott College (JAC). Issues addressed in the study included the differences between students persisting in and those transferring out of science programs, female representation in science programs at JAC, and the differences, if any, between male and female students' performance in science courses and their reasons for transferring out of science. All students accepted into science programs for fall 1986 were mailed an admissions survey which solicited data on educational background, reasons for choosing science, university plans, and perceptions of factors which influenced their enrollment and performance in science. A very high return rate yielded 455 usable surveys. For the next four semesters, all students who requested a change of program filled out a questionnaire designed to identify their reasons for leaving the program. After winter 1988, transcripts were studied for academic performance and to confirm data. Study findings included the following: (1) female representation (37.6%) was much lower than male representation in the science programs; (2) females enrolled at a much higher rate in health science (22.2%) than in pure and applied science (15.3%); (3) female students had significantly higher overall grade point averages after four semesters than the males; (4) in health sciences, females enrolled in basic courses rather than advanced courses much more often than males; (5) only 20% of the male students graduated after four semesters, compared to 32% of the females; (6) transferees out of science subsequently chose programs in commerce and social sciences; (7) both genders, but particularly the females, perceived themselves as having little control over their lack of success; (8) both males and females ranked chemistry as the most difficult subject; and (9) female persisters' parents tended to be more highly educated than female transferees' parents, but no such differences were found for males. The survey instrument and student comments are appended. (WJT)

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# PERSISTENCE IN SCIENCE: GENDER AND PROGRAM DIFFERENCES

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## CHAPTER 1 INTRODUCTION

The impetus for this study grew out of an earlier more limited one which focussed on the female science student population at John Abbott College and drew attention to the high female transfer rate out of science. Questions were raised about what differentiates persisters and transferees and whether male and female rates were comparable. It became apparent that a larger study including all science students, both male and female, was needed to investigate persistence rates and gender differences. This study, then, compares persisters and transferees in the Autumn 86 cohort in science programs at John Abbott, on variables relating to their performance and perceptions. In addition, it looks at gender differences in enrolment, performance and persistence.

At the point of admission, all science students were asked to complete a survey which was included with the admissions package. This survey provided data on the educational background of the students' families, the students' reasons for choosing science, their university and cegep plans, and their perceptions of factors which influenced enrolment and performance in Science. The purpose of gathering this data was to study initial student perceptions as possible predictors of persistence and success in the science programs. A change of program questionnaire was designed to identify reasons for (subsequently) leaving the sciences. Students were asked to fill this out when working with an academic advisor to process their requests for a change of program. Those students who changed their program during registration were mailed a questionnaire. In addition, student records were studied to investigate the relationship between performance in the first term and persistence in science.

Although it was hoped that the John Abbott data would be compared to those existing in the wider cegep system, this has not been possible because of inconsistencies in computerized reports.

## STATEMENT OF OBJECTIVES

This study addresses the issue of persistence in science programs at John Abbott College. In addition to comparing initial reasons for enroling in sciences programs and the performance of persisters and transferees, the study looks at differences between the male and female populations in science.

Questions addressed in this study are:

1. What are the differences between persisters and transferees? (reasons for choosing science, parents' education level, program options, sources of influences, perceptions on factors influencing performance, actual performance and course selection).

2. What is the female representation in science programs at JAC compared to male?

3. Are there sex differences in the proportion of transferees out of science?

4. Are there sex differences in the stated reasons for requesting a change out of science programs?

5. Are there sex differences in academic performance in science courses?

6. Are there sex differences in the academic performance of transferees out of science?

7. What are the factors associated with female students dropping out of science programs as opposed to male students?

8. In what ways do females and males transferring out of science differ from females and males who remain in the science program?

9. What is the relationship of success/failure attributions to persistence in science programs?

## METHODS AND PROCEDURES

During the Spring of 1986 Admissions period, all students accepted into the science programs for the Fall of 1986 were mailed the Admissions Survey (Appendix A) with their letter of acceptance. This survey was to be returned with their confirmation of acceptance. A very high return rate yielded over 500 completed surveys which were later reduced to 455 as some students did not register at the college or had prior cegep credits. Data was coded and transposed onto OPSCAN sheets for computerized scoring and was statistically analyzed using the CHI-square procedure in the SAS statistical program.

For the next four semesters, all students who requested a change of program were asked to fill out the Change of Program Questionnaire (Appendix A). Students processing their change of program requests through appointments with advisors were asked to fill out the questionnaire. Those students who made change of program requests at registration were mailed questionnaires. The gathering of this data proved to be more difficult than the initial survey but did result in a 60% return rate.

The Change of Program Questionnaire (Appendix A) was manually scored. Because of the descriptive nature of many of the responses and the restricted nature of the sample, inferential statistical comparisons were not carried out.

After four terms (Fall 1986, Winter 1987, Fall 1987, Winter 1988) transcripts were used to confirm data on the number of persisters and transferees and to study performance. These transcripts were manually sorted by credit levels and program. It was necessary to re-input all of the grades for these students on the computer to generate the findings found in Chapter 2.

The task of ensuring that the Admissions Survey data matched the students on the list of entering science students provided by the Records Department proved to be a very difficult and time consuming task as the data provided by the Records Department did not differentiate between first time registrants and students who had previously attended cegep. The list of change of program students needed to be verified manually. This required going back to OPSCANS (identified only by student number) and actual surveys to ensure complete and valid categorization of students.

The proposal for the study underestimated the need for computer support to analyze the 455 Admissions Surveys, the performance data, and the change of program data, as well as the accompanying statistical comparisons. Much of the work had to be done manually. We remain indebted to outside sources for the statistical analysis which appears in this report.

## CHAPTER 1 MALE/FEMALE REPRESENTATION IN SCIENCE PROGRAMS

Cegep students intending to pursue sciences at the Collegial level, and later at University may enter programs in either Health Sciences or Pure and Applied Sciences. The admission requirements to these programs are identical, requiring a background in high school Mathematics, Physics and Chemistry. The diploma requirements are the same in terms of selection of courses.

Students who select Health Sciences often envision university training in Health careers such as Medicine, Nursing, Pharmacy, Biology and Chemistry. The Pure and Applied Science student is likely to be headed towards Engineering, Architecture, Agriculture, etc. These students are likely to select additional Mathematics and Computer Science courses.

John Abbott does not segregate its science courses in terms of Health or Pure and Applied students, nor in terms of first of second year students. Traditionally, John Abbott has seen larger proportions of female students in Health Sciences and higher proportions of male in Pure and Applied Sciences. In the Fall of 1986, John Abbott had the following enrolment of new students in its science programs.

### 1.1 Enrolment

Male and female enrolments were compared for the Health Science program, The Pure and Applied (P&A) Science program, and both programs considered together.

**Table 1:1**
**New Students enrolled**
**in Science - Fall 1986**

| | Health Science | Pure and Applied | Combined |
|---|---|---|---|
| Male | 72 (14.7%) | 234 (47.8%) | 306 (62.4%) |
| Female | 109 (22.2%) | 75 (15.3%) | 184 (37.6%) |
| Total | 181 (36.9%) | 309 (63.1%) | 490 |

**Female representation is lower than male in Science (both programs considered together). However, more females than males enroll in Health Sciences whereas the opposite is true for Pure and Applied.**

In order to establish whether female representation in Science is significantly lower than in non-science programs we would need enrolment figures for the latter.

**1.2 Persistence vs Transfer**

The initial focus of this study was to examine persistence in Science and establish whether differences - if any - might be attributable to gender. Table 1.2 shows the numbers of students enrolled in Science and the rates at which they persist or transfer out of Science. In addition to "persists" and "transfers", an additional 101 students initially enrolled in Science in the Fall of 1986 left the College before completing four semesters. This group will be examined separately later in this report.

Thirty-one percent of all students who enrolled in science for the first time in A 86 and who completed four semesters at JAC transferred out of science. The rates, at which **male** (32.1%) and **female** (28.9%) students switched out are not significantly* different.

A few students switched within science programs:
. 2 male, 3 female students switched out of 010 into 020
. 3 male, 1 female students switched out of 020 into 010;
These students have not been included among the "tranfers" since, even though they changed programs, they remained in science.

In conclusion, when broken down by each science program:

(I) Thirty percent of all Health (010) students who completed four semesters at JAC transferred out of science. The rates at which male students (26.8%) and female students (38.1%) transferred out are not significantly different.

(II) Thirty-one percent of all Pure & Applied Science (020) students who completed four semesters at JAC transferred out of science. Here again, the rates at which male students (33.7%) and female students (23.1%) transferred out are not significantly different.

**We consider such transfer rates extremely high. These rates should be carefully monitored to determine if the 1986 cohort of science students was exceptional or if there is a need for inquiring into the reasons for such a "hidden failure rate."**

**Table 1.2**
**Persistence vs Transfer**
**By Science program**

| **Health Science** | **Male** | **Female** | **Combined** |
|---|---|---|---|
| Persisters | 41 (73.2%) | 56 (66.7%) | 97 (69.3%) |
| Transferees | 15 (26.8%) | 28 (38.1%) | 42 (30.0%) |
| Left | 16 | 25 | 41 |
| TOTAL | 72 | 109 | 181 |
| **Pure and Applied** | | | |
| Persisters | 122 (66.3%) | 50 (76.9%) | 172 (69.1%) |
| Transferees | 62 (33.7%) | 15 (23.1%) | 77 (30.9%) |
| Left | 50 | 10 | 60 |
| TOTAL | 234 | 75 | 309 |
| **Health Science & Pure and Applied** | | | |
| Persisters | 163 (67.9%) | 106 (71.1%) | 269 (69.2%) |
| Transferees | 77 (32.1%) | 43 (28.9%) | 120 (30.8%) |
| Left | 66 | 35 | 101 |
| TOTAL | 306 | 184 | 490 |

* In this report, confidence level is at the 0.05 level unless otherwise specified.

**CONCLUSIONS**

1. Female representation (37 percent of all Science students) is much lower than male (63 percent) in the Science Programs. Furthermore, the rate at which females enrol in Pure and Applied is very low compared to that at which they enrol in Health Science with an opposite conclusion for males. This should be of concern to the College community; ways should explored to encourage females to consider careers in pure and applied fields in science in view of the growing demand for engineers and scientists.

2. The transfer rate out of Science is very high (31 percent). This rate should be carefully monitored to determine whether the 1986 cohort of science students at JAC was exceptional or to inquire into the reasons for such a " hidden failure rate".

## CHAPTER 2 PERFORMANCE AND COURSE SELECTION DATA

### 2.1 Performance

Performance was compared for persisters and transferees and also by gender. Only those students completing four semesters subsequent to Autumn 1986 are included. The following criteria were used:

1) overall average
2) first-semester concentration average, i.e. one first -semester course in each of the mathematics, physics, and chemistry disciplines among Math 101, Math 103, Chem 111, Chem 201, Phy 111, and Phy 101
3) course choice among "basic" and "advanced" first -semester concentration courses
4) graduation rates.

-Female vs Male Performance

(I) Overall:

**Female students in our sample - both "transferees" and "persisters", and together ("all") - have a significantly higher overall average after 4 semesters than their male counterparts.** When re-examining this difference separately over the two contributing groups, Health Science and Pure and Applied, one notices that the differences are significant for the Pure & Applied group but not for the Health Science group.

(II) Concentration:

**Results are somewhat less clear for performance in first-semester concentration courses** with no significant male/female differences among "transferees" and "persisters". This result holds when re-examining each contributing group seperately.

-Transferees vs Persisters Performance

As might be expected, female and male students who persist in their original programs perform better than those who switch out. This is true for both science programs separately and together. The performance gap is much wider still for concentration courses.

The above conclusions relative to first-semester concentration averages fail to reflect the fact that students may take two types of courses - basic or advanced - in each of the mathematics, chemistry, and physics disciplines. Placement into appropriate levels is based on their high-school marks and, on their own choice. This point will also be further discussed in the next section.

## 2.1 Overall and first-semester concentration performances

**Table 2.1:**
**Comparison of Performance for overall and concentration averages by transferees vs persisters, Females vs Males**

| | All | | Transferees | | Persisters | |
|---|---|---|---|---|---|---|
| | F | M | F | M | F | M |
| **HEALTH SCIENCE & PURE AND APPLIED (COMBINED)** | | | | | | |
| Overall | | | | | | |
| n | 149 | 240 | 42 | 77 | 107 | 163 |
| x | 75.0* | 71.4* | 71.6* | 67.7* | 76.3* | 73.2* |
| s | 8.3 | 11.4 | 10.6 | 13.1 | 6.8 | 10.0 |
| Concentration | | | | | | |
| n | 119 | 192 | 27 | 48 | 92 | 144 |
| x | 69.8 | 67.4 | 56.5 | 56.7 | 73.7t | 71.0t |
| s | 13.9 | 15.6 | 13.3 | 16.7 | 11.4 | 13.6 |
| I' | 31 | 48 | 15 | 27 | 16 | 21 |
| **HEALTH SCIENCE** | | | | | | |
| Overall | | | | | | |
| n | 84 | 56 | 27 | 15 | 57 | 41 |
| x | 74.3 | 74.4 | 71.6 | 68.2 | 75.5 | 76.6 |
| s | 8.7 | 11.5 | 12.3 | 13.3 | 6.0 | 9.9 |
| Concentration | | | | | | |
| n | 64 | 49 | 18 | 10 | 46 | 39 |
| x | 68.1 | 68.1 | 55.6 | 53.8 | 73.0 | 71.8 |
| s | 14.5 | 15.4 | 13.3 | 15.9 | 11.8 | 12.9 |
| I' | 20 | 7 | 9 | 5 | 11 | 2 |
| **PURE AND APPLIED** | | | | | | |
| Overall | | | | | | |
| n | 65 | 184 | 15 | 62 | 50 | 122 |
| x | 75.8* | 70.6* | 71.6t | 67.5t | 77.1* | 72.1* |
| s | 7.7 | 11.2 | 6.7 | 13.1 | 7.4 | 9.8 |
| Concentration | | | | | | |
| n | 55 | 143 | 9 | 38 | 46 | 105 |
| x | 71.7 | 67.2 | 58.3 | 57.5 | 74.4 | 70.6 |
| s | 12.8 | 15.6 | 13.2 | 16.2 | 10.9 | 13.8 |
| I' | 11 | 41 | 6 | 22 | 5 | 19 |

x= average
s= standard deviation
I'= incomplete first-semester concentration sequence due to ABs or at least one course postponed to subsequent semester

* male-female difference significant
t trend not significant at the 95 percent level

## 2.2 Course Choice

Course choice was examined by tracking enrolment in first-semester concentration courses. These courses were identified as "basic" or "advanced":

- "basic" = Math 101, Chem 111, Phy 111
- "advanced" = Math 103, Chem 201, Phy 101.

Criteria for enrolling into advanced courses are:

Math 103: by placement test
Chem 201: based on high school provincial exam marks
Phy 101: by high school provincial exam marks and Advanced Math placement.

In a few instances, a Biology 301 grade has been substituted for a non-existing Chem 201 grade to reflect individual first-term choice patterns.

For instance, female enrolment (both for 010 and 020) in advanced courses was 383, 27 of which resulted in ABs, and the balance in passing or failing grades. Since most students take three science courses in their first semester, each student has been counted approximately three times.

**Table 2.2:**
**Course Choice: Number of students enrolled in Basic and Advanced patterns**

| Course Type | All | | Transfers | | Persists | |
|---|---|---|---|---|---|---|
| | F | M | F | M | F | M |
| **HEALTH SCIENCE & PURE AND APPLIED** | | | | | | |
| Basics | | | | | | |
| n | 383 | 597 | 112 | 179 | 271 | 418 |
| % | 87% | 84% | 93% | 89% | 85% | 82% |
| ABs | 27 | 33 | 13 | 22 | 14 | 11 |
| Advanced | | | | | | |
| n | 55 | 113 | 8 | 22 | 47 | 91 |
| % | 13% | 16% | 7% | 11% | 15% | 18% |
| Abs | 3 | 7 | 0 | 3 | 3 | 4 |
| Total | | | | | | |
| n | 438 | 710 | 120 | 201 | 318 | 509 |
| ABs | 30 | 41 | 13 | 25 | 17 | 16 |
| **HEALTH SCIENCE** | | | | | | |
| Basics | | | | | | |
| n | 228 | 141 | 72 | 39 | 156 | 102 |
| % | 92%* | 80%* | 94% | 87% | 91%* | 78%* |
| ABs | 20 | 5 | 8 | 5 | 13 | 0 |
| Advanced | | | | | | |
| n | 20 | 35 | 5 | 6 | 15 | 29 |
| % | 8%* | 20%* | 7% | 13% | 9%* | 22%* |
| ABs | 0 | 0 | 0 | 0 | 0 | 0 |
| **PURE AND APPLIED** | | | | | | |
| Total | 248 | 176 | 77 | 45 | 171 | 131 |
| ABs | 21 | 6 | 8 | 5 | 13 | 1 |
| Basics | | | | | | |
| n | 155 | 456 | 40 | 140 | 115 | 316 |
| % | 82% | 85% | 93% | 90% | 78% | 84% |
| ABs | 6 | 28 | 5 | 17 | 1 | 11 |
| Advanced | | | | | | |
| n | 35 | 78 | 3 | 16 | 32 | 62 |
| % | 18% | 15% | 7% | 10% | 22% | 16% |
| ABs | 3 | 7 | 0 | 3 | 3 | 4 |
| Total | 190 | 534 | 43 | 156 | 147 | 378 |
| ABs | 9 | 35 | 5 | 20 | 4 | 15 |

* male-female difference significant
AB figures are shown for interest although they have not been interpreted in detail.

Data in Table 2.2 show the following:

- **For the Health Science group: 1) no significant difference between females and males was found in performance as measured by the overall and first-semester concentration averages.**
  **2) the female students chose basic courses in much higher proportion than males did;**

- **For the Pure and Applied group: 1) a significant difference between females and males in performance was found in the overall average but not in the first-semester concentration average.**
  **2) female and male students chose advanced over basic courses in similar proportions.**

## 2.3 Graduation Rates

Graduation rates for Science students who obtained their DEC in four (4) semesters were examined. Table 2.3 shows that **only 25 percent of all science students graduate in four semesters.**

**Table 2.3:**
**Graduation Rate of A 86 Cohort**
**DEC Completed in four semesters**

| | enrolled | graduated | % graduated |
|---|---|---|---|
| **HEALTH SCIENCE & PURE AND APPLIED** | | | |
| Male | 306 | 62 | 20.3%* |
| Female | 184 | 58 | 31.5%* |
| Total | 490 | 120 | 24.5% |
| **HEALTH SCIENCE** | | | |
| Male | 72 | 19 | 26.4%ns |
| Female | 109 | 27 | 24.8%ns |
| Total | 181 | 46 | 25.4% |
| **PURE AND APPLIED** | | | |
| Male | 234 | 43 | 18.4%* |
| Female | 75 | 31 | 41.3%* |
| Total | 309 | 74 | 23.9% |

**Female students were able to graduate in four semesters in a** significantly higher proportion than their male counterparts (32% vs 20%). This result, however, is attributable to the P&A group; **no difference was found among the Health group.**

Table 2.4 shows graduation rates after two full years, i.e. after five semesters including a summer term during which a number of close-to-graduate students usually enroll. The graduation rate now increases to almost 32%. The graduation trends already observed for the four-semester group hold with male students "catching up" a little.

**Table 2.4:**
**Graduation rates of A 86 Cohort**
**DEC Completed in 4 semesters (+ summer semester)**
**All students enrolled in Science**

| | enrolled | graduated | % graduated |
|---|---|---|---|
| **HEALTH SCIENCE & PURE AND APPLIED** | | | |
| Male | 306 | 89 | 29.1%t |
| Female | 184 | 67 | 36.4%t |
| Total | 490 | 156 | 31.8% |
| **HEALTH SCIENCE** | | | |
| Male | 72 | 27 | 37.5%ns |
| Female | 109 | 33 | 30.3%ns |
| Total | 181 | 60 | 33% |
| **PURE AND APPLIED** | | | |
| Male | 234 | 62 | 26.5%* |
| Female | 75 | 34 | 45.3%* |
| Total | 309 | 96 | 31.1% |

t=trend not significant at 95% level.
* male - female difference significant

## CHAPTER 2 CONCLUSIONS

1. Female students in our sample have a significantly higher overall average after four semesters than their male counterparts; results are less clear for first-semester concentration courses.

2. Performance in first-semester science courses is not significantly different between male and female students; however,
   - in Health Sciences, female students enrol in basic courses rather than advanced courses in much higher proportions than their male counterparts do.
   - in Pure and Applied, male and female students enroll in basic and advanced courses in similar proportions.

3. Twenty-five percent of all Science students graduate in four semesters. It might be interesting to monitor this rather low graduation rate for Science students over time and compare it to that of non-science groups at JAC and in other Cegeps.

Male students graduated after four semesters in significantly lower proportion than their female counterparts (20 percent vs 32 percent). This disparity is mainly due to a very low graduation rate (18 percent) among Pure and Applied male students.

## CHAPTER 3 THE ADMISSIONS SURVEY DATA

In this section of the report, we initially compare the responses of all persisting and transfering students on the Admissions survey. Since an overall statistical analysis indicated no significant differences between female and male responses, we have compared the responses of persisting females with transfering females and persisting males with transfering males.

In each instance we will indicate the question being examined, present data in tabular form and offer our interpretations.

Question: Are there differences in levels of education of the parents of persisters and transferees?

**TABLE 3.1**
LEVEL OF EDUCATION OF PARENTS

| | LEVEL OF EDUCATION | ELEMENTARY | SECONDARY | COLLEGE | TRADE/ TECHNICAL | UNIVERSITY | N/A |
|---|---|---|---|---|---|---|---|
| FATHER | PERSISTERS | 5.6 | 18.2 | 8.2 | 13.5 | 52.4* | 2.2 |
| | TRANSFEREES TOTAL | 5.1 | 25.7 | 15.4 | 13.2 | 39.0* | |
| MOTHER | PERSISTERS | 5.6 | 32.3 | 18.2 | 11.9 | 30.7t | |
| | TRANSFEREES TOTAL | 6.6 | 28.7 | 25.7 | 16.2 | 20.6t | |

N/A = NO ANSWER
* = SIGNIFICANT (0.04)
t = TREND (0.06)

There is a significant difference in father's education level between persisters and transferees, with fathers of the former being more highly educated.

There is a trend for mothers of persisters to be more highly educated.

Question: Is there a difference in the level between education of the parents of female persisters and female transferees and between male persisters and male transferees?

**TABLE 3.2**
**LEVEL OF EDUCATION OF PARENTS**

| | | | ---------- % ---------- | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | LEVEL OF EDUCATION | ELEMENTARY | SECONDARY | COLLEGE | TRADE/ TECHNICAL | UNIVERSITY | N/A |
| FATHER | MALE | PERSISTERS | 5.0 | 20.0 | 10.0 | 8.0 | 54.0 | 3.0 |
| | | TRANSFEREES | 2.3 | 23.3 | 14.0 | 10.5 | 48.8 | 1.2 |
| | | TOTAL | 4.2 | 21.0 | 11.2 | 8.7 | 52.4 | 2.4 |
| | FEMALE | PERSISTERS | 6.7 | 15.1 | 5.0 | 22.7 | 49.7** | 0.8 |
| | | TRANSFEREES | 10.0 | 30.0 | 18.0 | 18.0 | 22.0** | 2.0 |
| | | TOTAL | 7.7 | 19.5 | 8.9 | 21.3 | 41.4 | 1.2 |
| MOTHER | MALE | PERSISTERS | 6.5 | 34.5 | 18.5 | 10.5 | 28.0 | 2.0 |
| | | TRANSFEREES | 4.7 | 29.1 | 29.1 | 12.8 | 23.3 | 1.2 |
| | | TOTAL | 5.9 | 32.9 | 21.7 | 11.2 | 26.6 | 1.7 |
| | FEMALE | PERSISTERS | 4.2 | 28.6 | 17.6 | 14.3 | 35.3t | 0 |
| | | TRANSFEREES | 10.0 | 28.0 | 20.0 | 22.0 | 16.0t | 4.0 |
| | | TOTAL | 5.9 | 28.4 | 18.3 | 16.6 | 29.6 | 1.2 |



N/A = NO ANSWER
** = HIGHLY SIGNIFICANT (0.002)
T = TREND (0.09)

There is a highly significant difference between female persisters' and female transferees' father's level of education. Female persisters' fathers are more highly educated. There is also a trend for persisters' mothers to be more highly educated.

Question: Do persisters and transferees differ in their reasons for enroling in a science program?

TABLE 3.3
MAIN REASON FOR ENROLING
IN A SCIENCE PROGRAM
PERSISTERS VS TRANSFEREES

| REASON | PERSISTERS | TRANSFEREES | TOTAL | |
|---|---|---|---|---|
| A. Like Science | 20.7 | 21.3 | 20.9 | |
| B. Done well in science | 8.8 | 5.9 | 7.9 | |
| C. Required as a career choice | 33.2 | 30.1 | 32.3 | |
| D. Keep options open | 35.4 | 41.2 | 37.1 | |
| E. Other | 1.9 | 1.5 | | |

There are no significant differences between persisters and transferees in their main reasons for enroling in a science program.

QUESTION: 1. Do persisting and transfering females differ in their reasons for enroling in science?

2. Do persisting and transfering males differ in their reasons for enrolling in science?

TABLE 3.4
MAIN REASON FOR ENROLING
IN A SCIENCE PROGRAM
- % -
FEMALE VS MALE

| REASON | PERSISTERS F | PERSISTERS M | TRANSFEREES F | TRANSFEREES M | | |
|---|---|---|---|---|---|---|
| A. Likes Science | 13.4 | 25.0 | 20.0 | 22.1 | | |
| B. Done well in science | 12.6 | 6.5 | 8.0 | 4.7 | | |
| C. Required as a career choice | 39.5 | 29.5 | 42.0 | 23.3 | | |
| D. Keep options open | 33.6 | 36.5 | 28.0 | 48.8 | | |
| E. Other | 0.8 | 2.5 | 2.0 | 1.2 | | |

There is no difference between persisting and transfering females in their reasons for choosing science. The same is true of persisting and transfering males.

Question: What options other than science were considered when you enrolled?

TABLE 3.5

| STUDENT STATUS | | ------ % ------ | | | | |
|---|---|---|---|---|---|---|
| | | OPTIONS CONSIDERED | | | | |
| | | NONE | COMMERCE | SOCIAL SCIENCE | COMMERCE AND SOCIAL SCIENCE | OTHER |
| PERSISTERS | FEMALE | 75.6 | 10.1 | 5.9 | 1.7 | 5.9 |
| | MALE | 75.0 | 15.0 | 4.0 | 0.5 | 5.5 |
| TRANSFEREES | FEMALE | 70.0 | 18.0 | 10.0 | 0.0 | 2.0 |
| | MALE | 58.1 | 24.4 | 8.1 | 0.0 | 9.3 |
| TOTAL | FEMALE | 74.0 | 12.4 | 7.1 | 1.2 | 4.7 |
| | MALE | 66.9 | 17.8 | 5.2 | 0.3 | 6.6 |
| TOTAL OPSCAN | | 71.4 | 15.8 | 5.9 | 0.7 | 5.9 |

No statistical analysis was done, but it is apparent that three-quarters of the students had not considered any option other than science.

Question: What are the differences between persisting and transfering students in sources of influence on their decisions to enrol in science?

RELATIVE INFLUENCE ON DECISION TO ENROL IN SCIENCE:
DEGREE OF INFLUENCE X GENDER, COMPARISON OF PERSISTERS & TRANSFEREES.

TABLE 3.6

| | DEGREE OF INFLUENCE | | | | | |
|---|---|---|---|---|---|---|
| | GREAT | | SOME | | LITTLE | |
| | PERSISTERS | TRANSFEREES | TRANSFEREES | PERSISTERS | PERSISTERS | TRANSFEREES |
| SCHOOL GUIDANCE COUNSELLOR | 8.2 | 11.8 | 25.1 | 25.7 | 66.1 | 61.8 |
| TEACHERS | 7.2 | 8.8 | 41.7 | 47.8 | 50.5 | 42.6 |
| SIBLINGS | 11.0 | 9.6 | 20.4 | 20.6 | 67.1 | 66.9 |
| PARENTS | 25.4 | 41.2 | 42.6 | 34.6 | 21.6 | 24.3 |
| FRIENDS | 11.6 | 12.5 | 35.7 | 47.1 | 52.4 | 40.4 |

There are no significant differences between persisters and transferees in sources of influence on their decision to enrol in science. Of note, is the little influence of all sources except parents.

Question: 10 - 14
What are the gender differences in the persisting and transfering students in sources of influence on decision to enrol in science.



TABLE 3.7

RELATIVE INFLUENCE ON DECISION TO ENROL IN SCIENCE:
DEGREE OF INFLUENCE X FEMALE/MALE AND TRANSFEREES/PERSISTERS

| | DEGREE OF INFLUENCE TRANSFEREES | | | | | | DEGREE OF INFLUENCE PERSISTERS | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GREAT | | SOME | | LITTLE | | GREAT | | SOME | | LITTLE | |
| | FEMALE | MALE | FEMALE | MALE | FEMALE | MALE | FEMALE | MALE | FEMALE | MALE | FEMALE | MALE |
| SCHOOL GUIDANCE COUNSELLOR | 18.0 | 8.1 | 24.0 | 26.7 | 58.0 | 64.0 | 8.4 | 8.0 | 21.8 | 27.0 | 68.9 | 64.5 |
| TEACHERS | 10.0 | 8.1 | 52.0 | 45.3 | 38.0 | 45.3 | 6.7 | 7.5 | 46.2 | 39.0 | 46.2 | 53.0 |
| SIBLINGS | 6.0 | 11.6 | 18.0 | 22.1 | 76.0 | 61.6 | 10.1 | 11.5 | 19.3 | 21.0 | 68.1 | 66.5 |
| PARENTS | 44.0t | 39.5 | 30.0 | 37.2 | 26.0 | 23.3 | t 32.8 | 37.0 | 47.1 | 40.0 | 20.2 | 22.5 |
| FRIENDS | 16.0tt | 10.5 | 48.0 | 46.5 | 36.0 | 43.0 | tt 10.1 | 12.5 | 36.1 | 35.0 | 53.8 | 51.5 |

t = (0.08) tt = (0.07)



There is a trend for differences between persisting and transfering females in parental influence with transfering females acknowledging more parental influence. There are no differences for males. There is also a trend for transfering females to acknowledge greater influence by friends. No differences are observed for males.

Question: Do persisting and transfering students differ in their perceptions of what factors influence a student's performance in a science course?

STUDENT PERCEPTIONS OF THE RELATIVE IMPORTANCE OF FACTORS INFLUENCING HOW WELL A STUDENT DOES IN A SCIENCE COURSE: PERSISTERS & TRANSFEREES & COMPARISONS.

TABLE 3.8

| FACTOR | DEGREE OF INFLUENCE | | | | | |
|---|---|---|---|---|---|---|
| | ---------- % ---------- | | | | | |
| | GREAT | | SOME | | LITTLE | |
| | PERSISTERS | TRANSFEREES | PERSISTERS | TRANSFEREES | PERSISTERS | TRANSFEREES |
| ACADEMIC ABILITY | 53.6 | 44.9 | 44.2 | 53.7 | 0.6 | 1.5 |
| EFFORT | 89.3 | 90.4 | 8.5 | 9.6 | 0.6 | 0 |
| INTEREST IN SUBJECT | 44.5 | 41.2 | 48.6 | 52.9 | 5.3 | 5.9 |
| GOOD TEACHERS | 61.1 | 66.9 | 34.2 | 29.4 | 2.2 | 3.7 |
| OTHER | 21.9 | 18.4 | 20.4 | 22.8 | 54.5 | 58.1 |

There are no differences between persisters and transferees in their perceptions of the relative importance of factors influencing how well a student does in science courses.

Question: Are there within-gender differences in persisting and transfering students in their perceptions of what factors influence a student's performance in science?

**TABLE 3.9**

STUDENT PERCEPTIONS OF THE RELATIVE IMPORTANCE OF FACTORS INFLUENCING HOW WELL A STUDENT DOES IN SCIENCE COURSES: MALE/FEMALE TRANSFEREES/PERSISTERS.

| FACTORS | DEGREE OF INFLUENCE - TRANSFEREES | | | | | | DEGREE OF INFLUENCE - PERSISTERS | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ------ % ------ | | | | | | ------ % ------ | | | | | |
| | GREAT | | SOME | | LITTLE | | GREAT | | SOME | | LITTLE | |
| | FEMALE | MALE | FEMALE | MALE | FEMALE | MALE | FEMALE | MALE | FEMALE | MALE | FEMALE | MALE |
| ACADEMIC ABILITY | 52.0 | 40.7 | 44.0 | 59.3 | 4.0 | 0 | 58.0 | 51.0 | 37.8 | 48.0 | 1.7 | 0 |
| EFFORT | 96.0 | 87.2 | 4.0 | 12.8 | 0 | 0 | 89.9 | 89.0 | 7.6 | 9.0 | 0 | 1.0 |
| INTEREST IN SUBJECT | 36.0 | 44.2 | 54.0 | 52.3 | 10.0 | 3.5 | 37.8 | 48.5 | 55.5 | 44.5 | 4.2 | 6.0 |
| GOOD TEACHERS | 60.0 | 70.9 | 34.0 | 26.7 | 6.0 | 2.3 | 64.7 | 59.0 | 29.4 | 37.0 | 1.7 | 2.5 |
| OTHER | 18.0 | 18.6 | 14.0 | 27.9 | 68.0 | 52.3 | 25.2 | 20.0 | 11.8 | 25.5 | 58.8 | 52.0 |



Within-gender comparisons yield no significant difference in their perceptions of what factors influence a student's performance in science

## CHAPTER 4 PERCEPTIONS OF CHANGE-OF-PROGRAM (COPQ) STUDENTS

### INTRODUCTION

The Change of Program Questionnaire (COPQ) in Appendix A was designed to survey the perceptions of students at the time they applied for a change of program out of sciences. However, since many students made application for transfer on the floor of registration where time pressures and a stressful atmosphere precluded its use, the questionnaire was mailed to them. This may have affected the rate of response. Sixty percent ( 60%) replied, with the female response rate being higher than that of the males. Females comprised 44.4% of the COPQ sample, but 37.4% of the transferee group. The make-up of the sample, by gender and program, appears in Table 4.1. The COPQ gender proportions for each program are remarkably similar to those found in the entire transferee population. The female proportions were exactly the same, while the male proportions were 20.0% vs 21.6% in Health Sciences and 80.0% vs 78.4% in Pure and Applied. However, because the restricted size of the COPQ sample suggests a possible lack of representativeness, and the relatively larger proportion of females may bias the combined data, no statistical tests of significance were carried out. Rather, the data were examined for patterns and possible trends. **Caution is urged in drawing conclusions from the data and the interpretations.**

**Table 4.1. Original programs and gender proportions of COPQ respondents.**

| | Gender proportions | | |
|---|---|---|---|
| | Female | Male | Combined |
| | (%) | | |
| Health Science | 66.7 | 20.0 | 40.7 |
| Pure and Applied | 33.3 | 80.0 | 59.2 |
| Combined | 44.4 | 55.6 | 100 |

## RESULTS

1. Choice of program following transfer out of science.

Tabulation of the students' program choices following their switch out of science indicated that the largest proportion of both males and females chose Commerce, with Social Sciences second (Table 4.2).

**Table 4.2. New programs chosen by COP survey respondents.**

| Program | Gender proportions | | |
|---|---|---|---|
| | Female | Male | Combined |
| | ----------% | | ---------- |
| Commerce | 47.2 | 64.4 | 56.8 |
| Social Science | 19.4 | 20.0 | 19.8 |
| Literature and Languages | 16.6 | 0.0 | 7.4 |
| Creative Arts | 2.7 | 6.7 | 4.9 |
| Technology | 13.9* | 0.0 | 6.2 |
| Other | 0.0 | 8.9** | 4.9 |

* Nursing (4 students); Correctional technology (1 student)
** Fine Arts (1 student); IP (1 student); General Admission (1 student); Unanswered (1 student).

A sizeable proportion of females (16.6%) chose Literature and Languages, with 13.9% choosing a technology. No COPQ males chose either of these options.

2. Main reason for choosing science.

The highest proportion of both genders (51.1% males, 38.9% females) in the COPQ sample listed "keeping options open" as the major reason for having enrolled initially in a science program (Table 4.3). This choice coincides with the data from the admissions questionnaire and indicates a consistency in responses over time.

**Table 4.3. Main reason for enrolling in a science program, COPQ respondents**

| Reason | Gender Proportions | |
|---|---|---|
| | Female | Male |
| | ---------- % ---------- | |
| Likes science | 22.2 | 13.3 |
| Had done well in science | 16.6 | 11.7 |
| Science required career choice | 22.2 | 20.0 |
| Wanted to keep options open | 38.9 | 51.1 |
| Other* | | 4.4 |

* pressure from parents, teachers and/or counsellors (3)

More COPQ females than males affirmed that liking science was a major factor in their decision to enter the science programs. In the admissions questionnaire the proportion of females and males who gave "liking science" as their main reason was approximately equal. This discrepancy may be due to the restricted COPQ sample, or may reflect a change in perceptions over time. Pressure from parents, teachers and counsellors was written-in as a main reason by three of the students.

3. Reasons for transferring out of science.

The students' reasons for switching out of science are a central concern in this study (Table 4.4). Failure or " not doing well" was cited by more females ((83.4%) than males (68.9%). Thirty percent of males stated that they had been doing well but had found other interests while only 13.9% of the females so stated. These self-reports conflict with previous data (Table 2.10) which show that, on the average, females had higher grades than males at the time of their transfers out of science.

**Table 4.4. Reasons for transferring out of science, COPQ respondents.**

| Reason | Gender Proportions | |
|---|---|---|
| | Female | Male |
| | % | |
| Failed courses | 41.7 | 40.0 |
| Not failing, but not doing well | 41.7 | 28.9 |
| Doing well but found other interests | 13.9 | 31.1 |
| Unanswered | 2.7 | |

4. Factors contributing to lack of success in science.

Further insights on the foregoing anomaly might be gained from data acquired when students were asked to indicate whether or not certain factors contributed "greatly, some, or little" to their failure. Students who had previously indicated that they were switching out of science although they were doing well were instructed to omit this portion of the questionnaire. Five out of 36 of the females omitted this question which is consistent with responses provided in Table 4.4. However, although 14 males had said they were doing well, and therefore should have omitted the question nevertheless, almost half of them answered it anyway. Do females and males perceive success and failure differently? Are females more sensitive to poor grades? Or, are males just poorer readers of instructions? Whatever the underlying reasons, half the males who at one point in the questionnaire reported they had done well in science, subsequently acknowledged factors that had " contributed greatly" to their lack of success (Table 4.5).

**Table 4.5. Self report of factors contributing "greatly" to lack of success in science.**

| Reason | Gender Proportions | |
|---|---|---|
| | Female | Male |
| | ---------- % ---------- | |
| My abilities not suited to science | 19.4 | 5.4 |
| Too much work | 22.5 | 24.3 |
| Courses not well taught | 22.5 | 32.4 |
| High school preparation was insufficient | 12.9 | 16.2 |
| Bad luck; factors beyond my control | 9.7 | 10.8 |
| Did not apply myself | 29.0 | 37.8 |

* percentages add up to more than 100 because students could cite more than one reason

Failure to apply oneself was the most frequently cited reason by both genders for lack of success. However, more males (37.8 %) than females (29.0%) acknowledged it. Poor teaching and heavy workload were also cited by a sizeable proportion of both males and females. Relatively few students complained that high school preparation was insufficient.

It is interesting that gender differences exist in attributing failure to lack of ability. More females than males reported "my abilities not suited to science" as a contributing factor.

The factors which the students were asked to consider varied on two dimensions--internal versus external and stable versus unstable. For example, "did not apply myself" and "my abilities are not suited to science" are both internal factors, but the latter is stable, relatively unchangeable, and therefore not under the student's control while the former, being unstable,(changeable) may be controlled. Other factors such as workload, courses not well taught, etc. are classified as external factors and are largely stable and uncontrollable since students have little choice in course or teacher selection. Previous research (Dweck & Elliott, 1983) has indicated that lack of persistence in the face of difficulties or failure is often associated with attributions of that failure to stable factors, internal or external, since they are seen as being beyond one's own control. Resilience and persistence in the face of failure are most likely to occur when students attribute lack of success to internal, unstable factors which are within themselves and can be changed.

If this is indeed so, we would predict that a large proportion of students transferring out of science would attribute their lack of success to factors beyond their control (the external and internal stable factors on the checklist) and few would attribute failure to lack of effort, the unstable internal factor on the list. This is partially supported by the data. Although "did not apply myself" was the single most frequently cited factor by both genders, it was selected by only 29% of the females and 37.8% of the males. This suggests that only about a third of the sample felt that they had had much control over, or could be personally responsible for, what had happened to them.

5. What might have kept the students in the science programs ?

Students were asked to choose the single most compelling factor which, if present, would have ensured their persistence in science .

**Table 4.6. What would it have taken to keep you in science?**

| Reason | Gender Proportions | |
|---|---|---|
| | Female | Male |
| | % | |
| Better grades | 44.4 | 35.6 |
| More interesting courses | 16.7 | 22.2 |
| Lighter workload | 13.9 | 8.9 |
| A career goal | 16.7 | 15.6 |
| Better teachers | 8.3 | 8.9 |
| Other* | | 8.9 |

* no family problems,a change in my ideology, a melange- no one thing, if communication courses had been included.

Not surprisingly, better grades was the most frequently mentioned choice, followed by more interesting courses (Table 4.6). It was hypothesized that more females than males would pick "if I had had a career goal ", assuming that females may perceive that they have less access to science careers than males. However, this was not confirmed by our data. Indeed, it is surprising that so few students of both genders selected this option, given the common perception that many of the students in early semesters at Cégep do not appear to have a career goal.

6. Student ratings of science courses.

Students were asked to rate their science subjects as to level of interest and difficulty (Table 4.7). Gender differences for reported level of interest in the various subjects reflect some widely held stereotypes. Almost 2/3 of the female students taking biology found it of great interest, while less than 1/3 males enrolled found it so. Males (44.4%) reported physics to be of great interest compared to 22.9 % of the females. A sizeable proportion of both genders found chemistry of little interest and of great difficulty. Math faired somewhat better, especially among the females. The correlation between stated interest in and perceived difficulty of a particular subject was not calculated but a negative relationship suggests itself from the data. Whether the association is a cause effect one cannot , of course, be determined from a study of this type.

**Table 4.7. Ratings of science courses by interest and difficulty, male versus female comparisons.**

| | Interest Level | | | | | |
|---|---|---|---|---|---|---|
| Subject | Great | | Moderate | | Little | |
| | f | m | f | m | f | m |
| | ---------- % ---------- | | | | | |
| Chem | 22.2 | 17.8 | 36.1 | 35.6 | 41.7 | 46.7 |
| Math | 30.1 | 25.0 | 41.7 | 44.4 | 27.7 | 31.1 |
| Physics | 22.9 | 44.4 | 42.9 | 28.9 | 34.3 | 26.7 |
| Biology | 65.2 | 29.2 | 26.1 | 50.0 | 8.7 | 20.8 |
| | Difficulty Level | | | | | |
| | ---------- % ---------- | | | | | |
| Chem | 44.4 | 37.8 | 50.0 | 51.1 | 5.6 | 11.1 |
| Math | 36.1 | 37.8 | 52.8 | 44.4 | 11.1 | 17.7 |
| Physics | 42.9 | 33.3 | 48.6 | 42.2 | 8.6 | 24.4 |
| Biology | 26.1 | 12.5 | 43.5 | 50.0 | 30.4 | 37.5 |

7. Voluntary comments offered by the students.

At the end of the questionnaire, students were asked to include any additional comments that they wished to make. A general classification appears in Table 4.8. Verbatim accounts, with identifying names deleted, appear in Appendix B. It is strongly recommended that these statements be read as it is impossible to convey their true flavor in a summary table.

Seventy percent of the sample offered comments with more males (80%) than females (67%) doing so. There were also gender differences as to content (Table 4.8). Female students commonly cited a loss of interest in the sciences with several saying they had found new interests with which they were pleased. A disturbingly frequent theme, particularly among males, was a dissatisfaction with what they perceived to be teacher apathy, lack of concern for students and poor teaching skills. While it is acknowledged that the generally negative tone of these comments may reflect a further bias in the sample (those with negative feelings tending to return the questionnaire, while those with neutral or positive ones being less likely to do so), the content may be nonetheless instructive and may well reflect the perceptions of a substantial proportion of the transferees.

Contrary to our expectations, only 14.8% of the students (19.4% male, 4.8% female) cited problems in the transition from high school to college per se as a hindrance to success.

It should also be noted that several students commented on their inability to comprehend the spoken English of some teachers. Further analysis seems to suggest that some of these are students for whom English is a second language.

## SUMMARY AND INTERPRETATION OF RESULTS

In spite of the sampling limitations,it is our belief that the responses to the COP questionnaire can provide insights into the experiences of students transferring out of science. The following interpretations and conclusions are offered:

1. Transferees out of science subsequently chose programs in commerce and social sciences. Since these courses are not offered in high school,one might ask if students are sufficiently aware of the existence of these programs before entering college, and if increased awareness would result in more students choosing them at the outset. Our data (Table 3.5) suggest that almost 3/4 of enrolling science students had considered no other program.

2. Keeping options open was the reason most frequently cited by both transferring females and males for enroling in science in the first place (Table 4.2). This does not appear to reflect a unique lack of committment to science from the outset by the transferees since a large proportion of those who persisted in the program also cited the same reason (Table 3.3). The pervasiveness

TABLE 4.8 SUMMARY OF STUDENTS' VOLUNTARY COMMENTS: GENDER COMPARISONS

| | SOURCE IN APPENDIX X | | PROPORTION OF SAMPLE | | |
|---|---|---|---|---|---|
| | | | ------ % ------ * | | |
| | FEMALE | MALE | FEMALE | MALE | COMBINED |
| 1. Complaints or comments about teachers | 1,6,10,13 | 3,4,6,7,11,12 13,18,19,22, 23,25,28,29, 30,34 | 19.1 | 44.4 | 35.1 |
| 2. Complaints or comments about program and/or workload | 3,10,11,15,16 | 1,11,17,21,23 32,33 | 23.8 | 19.4 | 21.1 |
| 3. Complaints or comments about own attributes | 9,14,17,19 | 5,8,14,15,25, 26,30 | 19.1 | 19.4 | 19.3 |
| 4. Complaints or comments about transition difficulties | 14 | 2,9,10,12,18, 20,34 | 4.8 | 19.4 | 14.0 |
| 5. Complaints or comments about preparation for CEGEP | 12 | 15,20,25,35 | 4.8 | 11.1 | 8.8 |
| 6. Complaints or comments on language problems | 4,12 | 6,11,28 | 9.5 | 8.3 | 8.8 |
| 7. Comments: interest level of courses and finding other interests. | 2,5,7,8,9,14, 15,17,18,20, 21 | 16,10,5,30,36 | 47.6 | 13.9 | 28.1 |

* percentages add up to more than 100, as some comments were applicable to more than one category.

of this choice suggests that perhaps students are being counselled to enrol in the sciences for this reason. It is worthwhile to consider if this is actually sound advice, especially for weak students. If a student chooses science and does poorly in it, then options are actually restricted and doors closed. Entrance to university in any program is dependent on good grades.

3. There appear to be some female/male differences in reasons given for transferring out of science (Table 4.4). More females cited failure to do well as a reason for transferring even though data on grades suggest they do better than males. (Table 2.1). More females than males also said that better grades was the main factor that would have kept them in science (Table 4.6). All this suggests that females may be more sensitive to failure than males.

4. Both genders, but particularly the females, perceive themselves as having little control over, and little personal responsibility for, their lack of success (Table 4.5). Only 29% of the females and 37,8 % of the males cited lack of effort as a factor contributing greatly to their own lack of success. Factors beyond their own control were cited by 89 % of the sample. This perceived lack of control was also reflected in some of the voluntary comments (See Appendix B) where students complained of lack of freedom in both course and teacher selection.

Not only did more males than females perceive that their lack of success was due to lack of effort, a controllable factor, but considerably more females (19.4%) than males (5.4%) believed that their abilities were not suited to science (an uncontrollable factor). When we consider that these results are based on the perceptions of the students and not necessarily on empirical evidence, it becomes important to ask why more females than males perceived themselves as lacking control over their achievement. Are women socialized to believe they can't do well in the sciences? Previous research would seem to support this notion (Black, 1983).

It should be possible to directly address the problem of perceived lack of control in both males and females through educational programs in the first semester. Provision for more actual choice and control in selection of courses and teachers at registration would also help students to gain a sense of personal responsibility for what happens to them. It is suggested that as long as students have little control, or perceive themselves as having little control, over teacher and course selection persistence rates in science in the face of difficulties will be relatively low.

5. Aside from better grades, the single most compelling factor that would have kept the transferring students in science was reported to be "more interesting courses". If we are concerned with retaining and attracting science students perhaps this issue should be directly addressed. What can be done to make science courses more interesting? Often educators dismiss student demand for interesting courses as simply a demand to be entertained, while

the students maintain that their lack of interest reflects a lack of relevance in the courses. Is it a question of relevance? What do students want? What do they need?

6. Both males and females ranked chemistry to be the most difficult subject, with females ranking physics as the second most and males so ranking mathematics. Student ratings of science courses by level of interest and difficulty reflected widely held stereotypes with the largest proportion of females ranking biology of great interest while males ranked physics. Perhaps of greater importance is the fact that even in the face of failure, low achievement, or other compelling interests, a sizeable proportion of both genders still expressed a great interest in at least one aspect of the sciences.

7. A high proportion of students, particularly males, voluntarily expressed dissatisfaction with their science teachers. This must be addressed, the possible bias of the sample notwithstanding. Many reasons may be suggested for this discontent. Perhaps the lack of freedom to choose one's teacher fosters it. Perhaps dissatisfaction with teachers is an indirect way of revealing the stresses produced by the change from the more structured, personal atmosphere of the high school to the less structured more impersonal atmosphere of college. If this is so, care might be taken to ensure that teachers who are willing to provide extra support are in charge of first semester classes. Placement of ESL students to ensure that the English they hear in class conforms to that which they are hearing in the larger society may help to alleviate some complaints about inability to comprehend the spoken English of some teachers. Further comments and suggestions regarding complaints made in the voluntary comments will be made at the end of the report.

## CHAPTER 5 SUMMARY OF FINDINGS AND RECOMMENDATIONS

### I GENERAL DESCRIPTIVE DATA ON THE A 86 COHORT

1. Females comprise 37% of science students. Males comprise 63%.

2. Health Science enrolment for female is 60.2%, male enrolment is 39.8%. Pure and Applied female enrolment is 24.3%, male enrolment is 75.7%.

3. Only 25% of the A 86 science student cohort graduated in four semesters.

4. 31% of students who enrol in science transfer out during the first four semesters. There are no gender differences in transfer rates.

5. Only 25% of science students graduate in four semesters.

### II PERFORMANCE AND COURSE SELECTION

GENDER DIFFERENCES
There are some significant differences in female/male performance throughout four semesters (A 86 - W 88):

- Female students in our sample have a significantly higher overall average after four semesters than their male counterparts.

- In Health Science, female students enrol in "basic" courses rather than "advanced" courses in much higher proportions than their male counterparts.

- Male students graduated in four semesters in significantly lower proportions than their female counterparts.

These findings suggest that there may be a relationship between performance, selection of basic level courses and graduation in four semesters. Further study is required.

GENDER SIMILARITIES
No significant female/male differences were found in:

- Performance in first semester science courses.

- The proportions in which females and males enrol in "basic" and "advanced" courses in the first semester.

PERSISTERS VS TRANSFEREES
Persisters perform better than those who transfer. This was true in both Health Science and Pure and Applied Science.

III THE ADMISSIONS SURVEY DATA

There are no significant differences in the female/male responses to the Admissions Survey. The only significant difference between persisters and transferees was in the level of education of parents. Fathers of persisters are more highly educated than fathers of transferees. There is a trend for persisters' mothers to be more highly educated than the transferees' mothers.

The following within gender-differences were found:

- There is a highly significant difference between female persisters' and transferees' fathers level of education. Female persisters' fathers are more highly educated.

- There was also a trend for female persisters' mothers to be more highly educated than those female transferees.

No such within-gender differences exist for males.
When answers to the admissions survey where compared for those who subsequently persisted and those who subsequently transferred out, it was found that:

- Females who subsequently transferred out of sciences acknowledged greater parental influence on their decision to enrol in science than their persisting counterparts. There was also a trend for transfering females to have acknowledged a greater influence of friends. No within-gender differences existed for males.

IV CHANGE OF PROGRAM QUESTIONNAIRE

1. Most transferees out of science subsequently chose programs in commerce and social sciences.

2. "Keeping options open" was the reason most frequently cited by both female and male transferring for having enrolled in science initially.

3. Both genders, but particularly females, perceived themselves having little control over, and little personal responsibility for their lack of success.

4. Aside from better grades, the single most compelling factor that would have kept the transferring students in science, was reported to be "more interesting courses".

5. Both genders ranked Chemistry as the most difficult subject. Females ranked Physics as the second most difficult and males ranked Mathematics as the second most difficult.

6. A sizeable proportion of both genders, even though failing, expressed great interest in at least one aspect of science. (75% of females ranked biology of great interest; 44% of males so ranked Physics).

7. A high proportion of students, particularly males (44%) voluntarily expressed dissatisfaction with their science teachers.

## RECOMMENDATIONS

The college needs to look at ways to reduce the transfer rate, and improve the graduation rate over four semesters. Our study suggests the following:

1. To provide extra support for students from families with lower levels of education. The only significant difference between persisters and transferees was the level of education of parents.

2. To study further the students' level of dissatisfaction with science teachers, and the gender differences in that dissatisfaction.

- Would placement of teachers willing to provide extra support in the first semester alleviate the level of dissatisfaction?
- Why do more males than females express teacher dissatisfaction?
- Do female and male science students receive the same kind of treatment by their teachers in science courses?

3. To increase contact with the parents of potential students since parents appear to influence students' decisions to enrol in Cégep programs.

- Incorporate opportunities into the college's high school liaison program.

4. To consider social data when researching questions on Cégep students since factors such as parent education level appear to be associated with student performance levels.

5. To address the problem of students' perceived lack of control through educational programs designed to enhance skills in self-management, assertion and communication in their first year.

- Incorporate this objective into the Orientation program and first semester courses.

6. To further address students' perceived lack of control by providing for more actual choice and control over the selection of courses and teachers.

- Offer courses for first semester students only.
- Allow first semester students to register first.
- Allow course changes.
- Allow students to opt for a reduced course load.
- Allow program flexibility for undecided students.

7. To continue to survey the perceptions of students in science, not only those who transfer out but those who persist in science to better understand and serve our science students.

# APPENDIX A

JOHN ABBOTT COLLEGE

QUESTIONNAIRE FOR NEW SCIENCE STUDENTS

Currently, a research team is collecting data on students entering science programs at John Abbott. Your honest answers to the following set of questions will be used to better understand why students enrol in science programs, and perhaps eventually help us adjust and change our programs to better meet student needs. All information is strictly CONFIDENTIAL. No names or student numbers will ever be released. We ask you to identify yourselves by name and student number so that we can follow you throughout your stay at John Abbott. We hope to compare trends of courseload, change of program and date of graduation over a period of several years. Your cooperation is essential to the success of our research study.

INSTRUCTIONS

You may indicate your answer directly on the questionnaire by circling your answer. Please feel free to comment in the space provided.

PLEASE RETURN THIS COMPLETED QUESTIONNAIRE WITH THE

REST OF YOUR ADMISSION MATERIALS

## SECTION I: BACKGROUND INFORMATION

NAME: _____

JOHN ABBOTT COLLEGE STUDENT NUMBER: 8 7 | | | | | |

PROGRAM: (A) ☐ HEALTH SCIENCE (B) ☐ PURE & APPLIED SCIENCE

SEX: (A) ☐ MALE (B) ☐ FEMALE

1. Which was the highest level of education your father completed?

   A. elementary
   B. secondary
   C. college or CEGEP
   D. trade or technical
   E. university

Father's occupation: _____

2. Which was the highest level of education your mother completed?

   A. elementary
   B. secondary
   C. college or CEGEP
   D. trade or technical
   E. university

Mother's occupation: _____

3. Do you have any brothers who are attending or have completed university?

   A. yes
   B. no

4. If yes, was science the area of study?

   A. yes
   B. no
   C. I don't know

5. Do you have any sisters who are attending or have completed university?

   A. yes
   B. no

6. If yes, was science the area of study?

   A. yes
   B. no
   C. I don't know

## SECTION II

7. What is the main reason you enrolled in a science program at CEGEP? Name only one!

   A. I like science.
   B. I have done well in science subjects in the past.
   C. Science is required in my career choice.
   D. I want to keep my career options open.
   E. Other. Please specify below.

Comment: _____

_____

(over) >

SECTION II - CONT'D

8. Do you plan to enrol in a science related program at university?

   A. yes
   B. no
   C. I don't know

   If yes, which program (s) are you considering? _____

   _____

9. When applying to CEGEP, did you seriously consider any other CEGEP program? (i.e. commerce, social science)

   A. yes
   B. no
   C. If yes, please name _____

| How much have the following people influenced your decision to enrol in a science program? | Great Influence A | Some Influence B | Little or No Influence C |
|---|---|---|---|
| 10. school guidance counsellor (s) | A | B | C |
| 11. teachers | A | B | C |
| 12. brothers and/or sisters | A | B | C |
| 13. parents | A | B | C |
| 14. friends | A | B | C |
| **Which of the following factors influence how well a student does in science courses?** | | | |
| 15. The student's academic ability | A | B | C |
| 16. The amount of effort the student puts into it | A | B | C |
| 17. Whether or not the subject is interesting | A | B | C |
| 18. Having good teachers | A | B | C |
| 19. Other, please name _____ _____ | A | B | C |

Now rank Items 15 to 19 in order of importance.

1. No. ____ (most important)
2. No. ____
3. No. ____
4. No. ____
5. No. ____ (least important)

JOHN ABBOTT COLLEGE

PERSISTENCE IN SCIENCE RESEARCH PROJECT

Once again, our research team is seeking your assistance in helping us understand your experience as a science student.. We are particularly interested in your decision to change your program.

You are part of a follow-up study on all students who entered science programs in the Fall of 1986. As such, it is vitally important to us to have your answers to this brief questionnaire if we are to adjust and change our programs to better meet student needs.

All information is strictly CONFIDENTIAL. No names or student numbers will ever be released. We ask you to identify yourself by name and student number so that we can correlate your answers with our computerized file on science students.

PLEASE INDICATE YOUR ANSWERS DIRECTLY ON THE QUESTIONNAIRE, AND RETURN IT IN THE SELF-ADDRESSED STAMPED ENVELOPE OR DROP-IT OFF IN STUDENT SERVICES H-148.

Thank you.

Researchers: Annick Boissett
Joan MacKenzie
Cathy Sidorenko

NAME: _____

STUDENT NUMBER: _____

1. Your original program was:
   (A) 010 Health Science
   (B) 020 Pure and Applied

2. Your new program is:
   (A) Social Science 030
   (B) Commerce 040
   (C) Creative Arts 050
   (D) Literature and Languages 060
   (E) Technology, please name _____

3. Did you change your program
   (A) At registration?
   (B) During the semester?

4. What was the major reason you enrolled in a science program at CEGEP? Name only one:

   (A) I like science, and found it interesting in high school.
   (B) I had done well in science subjects in the past.
   (C) Science was required for my career choice.
   (D) I wanted to keep my options open.
   (E) Other - please specify _____

5. Which reason for switching out of science best applies to you?

   (A) I'm failing my courses ( > continue to Question 6)
   (B) I'm not failing my courses, but I'm not doing as well as I would like ( > continue to Question 6)
   (C) I am doing well but I have found other interests that do not require science ( > continue to Question 12)

How much do each of the following factors contribute to your lack of success in the science courses?

| | Contributed Greatly | Contributed Some | Contributed Little |
|---|---|---|---|
| 6. My abilities are not suited to science | A | B | C |
| 7. It's too much work | A | B | C |
| 8. The science courses were not well taught | A | B | C |
| 9. My high school science preparation was insufficient for the JAC science program | A | B | C |
| 10. I was unlucky, things beyond my control prevented me from doing better | A | B | C |
| 11. I did not apply myself | A | B | C |

12. What would it have taken for you to stay in the science program? Choose only <u>one</u> which would have been most helpful:

(A) If I would have got better grades.
(B) If the courses would have been more interesting.
(C) If the workload had been lighter.
(D) If I had a career goal.
(E) If I had better teachers.
(F) Other, please name _____

_____

RATE EACH OF THE SUBJECTS BELOW IN TERMS OF BOTH <u>INTEREST</u> AND <u>DIFFICULTY</u>:

| | INTEREST | | | | DIFFICULTY | | | |
|---|---|---|---|---|---|---|---|---|
| | | GREAT | MODERATE | LITTLE | | GREAT | MODERATE | LITTLE |
| Biology | 13. | A | B | C | 14. | A | B | C |
| Chemistry | 15. | A | B | C | 16. | A | B | C |
| Mathematics | 17. | A | B | C | 18. | A | B | C |
| Physics | 19. | A | B | C | 20. | A | B | C |

21. Do you feel that your high school science background was sufficient preparation for the science program at John Abbott?

(A) Yes
(B) No
(C) Does not apply

Comment: _____

_____

_____

22. General Comments - please feel free to add your own general comments.

_____

_____

_____

_____

_____

_____

_____

_____

# APPENDIX B

## COMMENTS OF MALE STUDENTS

1. I think there should be a happy medium between high school and university. For example general biology here is the same course (in information given) as one of my friend's at the University of Guelph.

2. Entering Cégep was like hitting a brick wall. The sudden realization of total academic freedom was almost overwhelming. Students just out of high school do not have the responsibility to work in classes when they don't have to, or so they think! Something has to be done.

3. Teachers at Abbott rush through the course and just dismiss those that are not as talented. They are friendly with those who do well, only. The science teachers are not as interested in you as the commerce teachers. In commerce now I'm an honors student.

4. My teachers had a great impact on my changing programs. One teacher, ---------, that I had should not be teaching and failed people with pleasure.

5. Some people just can't do the sciences, I guess. I can't. I don't like to blame teachers. So I feel I'm just not made for it. I'm good in computer science, however, and am meeting this challenge.

6. Teachers have a technical interest. Some are great. Some are just terribly dry and don't know how to teach. Some are patient and willing but don't know how to put it across.

7. Some science teachers are hard to understand. I had a particular problem in math with ---------- whose english I couldn't understand. But I take most of the responsibility for my own situation. Also in chem with --------- Who was too rigorous.

8. I'm so lazy I think the only possible solution for me is to quit school and start working. My problem is I never needed to work at high school and was always getting marks over 80% and so when I started at college I don't know how to study and do homework.

9. I found it very hard to get into the rhythm of Cégep when I first got there. I had too much freedom all at once.

10 How well one does in school is determined by the effort one puts into it. In my case there was a great lack of motivation to do well as I never really wanted to go into science.

11. Chemistry was the hardest because there was little preparation for the final exam. All the important concepts were not taught in depth. My best teacher ever was -------, my math teacher and one of my worst was ---------. He was O.K. But I had difficulty understanding the way he spoke, plus the fact I'm french didn't

help much.

12. The change from H.S. in teachers and teacher apathy was large. I found a great lack of motivation on the part of both teachers and students.
13. I got 37 in English and never got back my work after handing it in.

14. I tried my best but I feel I cannot afford to fail.

15. I feel the reason for applying to the wrong program was due to lack of exposure to other courses and options in high school.

16. I was really tired of the sciences.

17. Mechanics 101 and Calculus 1 were too far advanced after pre-cal and physics 111.

18. I found that the switch from high school to CEGEP was quite difficult because of the size, the people, and other adjustments. But on top of this teachers such as _____ rushed us which caused us to have difficulty. I feel that teachers should understand the student's needs and feelings instead of just going into class, teaching, then leaving right after.

19. At JAC apathetic teaching contributes in some cases to dull classes. Other teachers were excellent but my future is too important to me to gamble with. If the teacher makes an effort to deliver more than just what is required, he will entice his students. I enjoyed science and found it interesting, but too much depended on the teacher one ended up with. If I could have _____ for all my science classes I'd still be there. Others were less stimulating and didn't care to know more than your student number. I guess I should be able to do well with any teacher, but I can't.

20. In high school I was not given sufficient options to find my interests.

21. Starting out in Chem 201 was probably a disadvantage in the first semester as 111 is stressed in the 101 course.

22. I felt teachers I had didn't give a dam about student progress and just were trying to weed people out. No interest on the teacher's part in SOME cases.

23. I found I was doing twice the homework as my friends but only getting half the marks and NO one was willing to give me a hand.

24. You have to really tell students they must work if they go into science, and not just to take it to keep their options open.

25. I didn't have pre-cal and physics 111 and I fell behind early,

largely because of my teacher I found him incompetent, but in physics not as incompetent. Chem I should have passed but I partied too much and this was all my fault.

26. My main reason I want to switch is basically lack of interest. I prefer the courses social has to offer.

27. My advice to other students. Don 't work at a job and try to do sciences.

28. Teaching was so variable-- very good and very poor. Too many teachers have accents that can't be understood. In business you can get a book and study up yourself. I want to be in control and I don't like being dependent on the luck of the draw in the teacher I get. In science you can't read up by yourself.

29. Teachers are a really big factor in science. In other subjects you can refer to books.

30. I got really turned off in physics but _____ really turned me on to writing. I guess it was really lack of motivation for me.

31. Guidance Counsellors in H. S. over stressed science and made me feel I couldn't get a job without it.

32. Your program took so much of my time. Your courses are too crammed. The student has no time. The field is too competitive.

33. I feel JAC's science program is a good one, but the course load is just IMPOSSIBLE....leaves no time for friends or a part-time job. The only way to pass is if you dedicate yourself and you know where your (sic) heading in life.

34 My background was sufficient but the change in teaching and teacher apathy was large. I found a great lack of motivation on the parts of both teacher and student.

35. The math taught in high school doesn't cover the basics taught in CEGEP. The physics in high school doesn't cover the optics in (sic) the difficulty of electricity taught in CEGEP.

36. The reason why I switched was because I really like computers and I'm pretty good at it. So I decided to change and I like it a lot so far.

**COMMENTS OF FEMALE STUDENTS**

1. I found the science field to be full of cold teachers . I felt on my own with teachers just trying to aggravate me more. I felt that they couldn't be bothered with what they were doing.

2. I just lost interest; I didn't know what I wanted to do.

3. I was in advanced math in high school. In pre-cal many of my earlier skills were forgotten.

4. Here is something I am bitter about. I had a teacher whose English I couldn't understand. I stuck with him for 2 years even though I failed his course. I was going to get him again for the 3rd time. When I protested at registration, they wouldn't change me so I phoned my parents and they agreed I should switch out of science. Now I've been accepted in languages at York and I sure won't be back here next year. You don't have to have your DEC to get in there. It"s too bad, though. I still like sciences.

5. I realized that I wanted to be a nurse...I don't feel in any way that my first semester was a waste - it helped me to find my career choice.

6. I was not well informed about the different levels of courses and that I could take less than seven courses. Also I feel that ---- is insufficient in teaching skills and that ---- is a total loss. Send these teachers to a school to learn how to teach.

7. I have a wide variety of interests but chose science because I felt I could do well in it. Now I'm not, so I want to try one of my other interests.

8. Another reason for changing is, I love to write and wish to teach others my love of it.

9.I realized I didn't want to spend the next ten years in school memorizing formulas and doing problems. I was already bored! I want to work with people-- how they feel, why they do what they do, etc.

10. I really like sciences but once I got to Abbott things seemed different. The Chemistry course I had done twice before, I failed at Abbott. I KNEW the material. The physics teacher never gave any notes. I was always "Go to the library".. ya, thanks alot. The math teacher was so speedy you didn't have time to read what was on the board before it was erased.

11. A science future is not my choice anymore. The workload is too heavy.

12. My general comment is that my first year at JAC was hard because I wasn't speaking English very much. So I had to learn the language and the language and the subject. Also, science in

high school is not the same as CEGEP.

13. I'm very happy that some research is being done on why science students are dropping out. In my opinion it's the teachers' faults. A good teacher is one who is organized, fair , can encourage struggling students and is basically a god. If the teacher lacks on of these qualities he/she lacks the potential for producing scientific minds willing to work for being quality people.

14. I feel I wasn't ready for the change from high school. I always got good grades in high school with little work. My studying abilities therefore were poor. I found the pressure too much, I have also found data processing which corresponds with my goals for the future.

15. It is important to have more complementaries in science programs so you can try your hand at other things too. In science there are so many prereqs. That's too bad. I've found something I love.

16. Requirements for university entrance for science are so high and in science your (sic) are not guaranteed a better grade even if you apply yourself more, as compared with other programs in CEGEP, science is definitely twice the workload and twice the heartache. For students who have done outstanding work in high school they become frustrated in CEGEP.

17. If I had stayed in science, I'm sure I would have passed but I wouldn't be happy. The science subjects are a waste of time.

18. I'm still taking math because I want to be an architect--interior design.

19. My choice of changing programs was a personal one only partially influenced by the results I had in the science program.

20. I wasn't 100% sure whether to go into Health Sciences ... I figured it would be easier to move down from Health rather than up to Health. I don't believe I 'quit' health, I just realized what I really wanted to do.

21. I'm just unhappy with the science program and need to explore other options.

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